

## 11. Acid Deposition

Acid deposition occurs when nitrate and sulfate ions in the upper atmosphere react with moisture in the air to form acid rain or precipitation. Monitoring of pH and other ion concentrations in precipitation helps identify trends and demonstrates the results of efforts made to reduce emissions from mobile and industrial sources.

### Sources

Sulfur and nitrogen oxides are emitted by automobiles, industries and agricultural sources. These oxides combine with water to form sulfuric acid and nitric acid.

### Effects

Many agricultural crops in North Carolina are sensitive to acid rain. Forests are subject to mineral loss from acid precipitation exposure and may also suffer root damage. Acid fogs and mists, typical in the mountains of North Carolina, can expose trees and plants to even higher acid concentrations and directly damage their foliage. Lakes, rivers, and streams that are too acidic impede fish and plant growth.

Effects of acidic depositions on wildlife are complex and difficult to evaluate. Documented direct effects on terrestrial wildlife are meager, but indirect effects may result from soil acidification and contamination of food sources. Acid deposition also may elevate amounts of toxic metals, especially mercury and cadmium, in soils, water and forage vegetation.

### Trends

Acidity is measured using a pH scale numbered from 0 to 14, with 0 being extremely acidic and 14 being extremely basic. A substance with a pH of five is ten times as acidic as one with a pH of six, 100 times as acidic as a substance with a pH of seven, etc. Neutral water with an equal concentration of acid and base ions has a pH of seven. Pure water in equilibrium with the air is slightly acidic, because of chemical reactions with carbon dioxide and other naturally occurring substances in the atmosphere. Annual averages of acidity in the United States range from pH 5.7 in the West to pH 4.1 in some areas of the Ohio Valley.

pH values have been monitored by agencies cooperating with the National Atmospheric Deposition Program/National Trends Network at several North Carolina sites since 1978. The statewide distributions of pH in 7-day wet deposition samples are shown, along with a trend line, in **Figure 17**. Although annual averages have fluctuated, the apparent average trend pH was approximately constant, near 4.55 until 1990. However, pH levels have drifted upward since 1990, to about 4.60 in 1995. The change since 1990 represents about a 10 percent decrease in average acidity. This improvement is occurring concurrently with the implementation of new controls on major sources, likely resulting from the 1990 revisions to the federal Clean Air Act.